A SECOND COLLECTION OF MAMMALS FROM CAVES NEAR ST. MICHEL, HAITI

By GERRIT S. MILLER, JR.

CURATOR, DIVISION OF MAMMALS, U. S. NATIONAL MUSEUM

(With 10 Plates)

Six years ago I published a short account of some bones of mammals from the floor material of two caves situated near St. Michel, north-central[1] Haiti (Smithsonian Misc. Coll., Vol. 74, No. 3, pp. 1-8, October 16, 1922). The small collection on which that paper was based had been made in 1921 by Mr. J. S. Brown and Mr. W. S. Burbank with the object of determining whether the caves contained deposits sufficiently rich in the remains of extinct vertebrates to justify a special expedition for their careful study. The few specimens brought home proved to be of so much interest that I visited Haiti in the spring of 1925, spending about four weeks at the plantation of l'Atalaye near St. Michel. A general account of this field-work appeared in Smithsonian Miscellaneous Collections, Vol. 78, No. 1, pp. 36-40, April 8, 1926. The following pages contain descriptions of the remains of mammals which I collected.

Concerning the caves themselves there is nothing important to add to the notes made by Mr. Brown and Mr. Burbank. Two smaller caves were found close to the large cavern near the town of St. Michel. One of these has the entire roof fallen in so that very little of the original floor material could be investigated. The other was in good condition for working, and the deposits which it contained proved to be exceptionally rich. Locally the region in which this group of caves is situated is known as St. Francisque. The cave in the dry valley north of the Atalaye plantation had been completely worked out for guano since it was examined by Mr. Brown and Mr. Burbank. Thus the interesting bone deposit which it contained had been almost totally destroyed. Nevertheless I succeeded in finding a few specimens scattered among the sifted limestone fragments with which the

[1] Not "at the northwest end" of the republic as I wrongly stated in my general account of the region.

floor is now covered to a depth of nearly 10 feet. On the top of the ridge bounding the west side of this valley are situated at least three caves which had not been previously examined. One of these has no opening other than a hole in the roof about 6 x 10 feet in diameter. The chamber beneath this hole appeared to extend downward more than 20 feet. Its lateral extent could not be determined, and I made no attempt to explore it. One of the other caves is unusually deep, while the third is of more normal form, but rather narrow and crooked. In both I found abundant remains of extinct mammals.

In all of these caves the deposits began at or near the surface and continued downward to a depth of about four feet. The bones then ceased, and further digging proved so fruitless that it was nowhere continued to rock bottom. Wherever bones occurred the deposit could be discovered in a few minutes' work with shovel or trowel; and at any spot where the first few minutes' digging revealed nothing the result of further excavation to a depth of six feet was fruitless. Mr. Brown and Mr. Burbank had previously found this to be the case.

Before going to St. Michel I spent a day working in a cave at Diquini, near Port-au-Prince. The conditions there appeared to be exactly the same as in the large cave at St. Francisque, but no bones were found other than a few remains of domestic goat and pig in the most superficial layers, and recent bats and introduced rodents in fresh owl pellets. Why this cave should have been barren of the extinct fauna which occurs so abundantly in those near St. Michel is a question to which I cannot suggest an answer.

Since this paper was written the St. Michel caves have been again visited in the interests of the National Museum. The generosity of Dr. W. L. Abbott enabled Mr. Arthur J. Poole, Scientific Aid, Division of Mammals, to spend the period from December 15, 1927, to March 15, 1928, in carrying on excavations which have probably resulted in exhausting the bone deposits. Inspection of the very rich material which he brought back to Washington shows that, in general, these new collections confirm the conclusions which I had reached after study of the specimens that I obtained myself. Such additional facts as they bring to light pertain chiefly to details concerning some of the new forms which I had already described in manuscript. I have therefore concluded to publish this paper as it was originally written, except for the account of the ground sloths, animals for whose understanding my material proves to have been so inadequate as to have led to conclusions which I now believe to have been wrong.

INSECTIVORA

Insectivores of the genus *Nesophontes* are abundantly represented in the Haitian caves. They have not previously been recorded from the island of Hispaniola. In the superficial layer of the cave floors the bones of these animals occur in undisturbed material along with remains of *Epimys rattus* and *Mus musculus*. This association is so intimate that there appears to be no reason to doubt the simultaneous occurrence of the insectivores and the introduced rodents. Some of the jaws of *Nesophontes* are more fresh in appearance than some of the jaws of *Rattus* near which they were found. Whether or not *Nesophontes* now exists alive is a question which for the present cannot be answered. No bones of insectivores have been found in any of the numerous fresh owl pellets which I have examined. It seems not improbable, however, that if any part of the island remains uninvaded by the roof rat, the native animal might now be found to exist there.

It is a noteworthy fact that up to the present time no remains of *Solenodon* have been found in any of the caves. This animal is so much larger than *Nesophontes* that its absence from deposits which are mostly owl-made might at first be thought to be due to this circumstance. Its size, however, is no greater than that of several of the rodents which were freely eaten by the extinct giant barn owl, of whose refuse the bone deposits chiefly consist. While it is therefore impossible to suggest any reasonable explanation of the absence of *Solenodon* bones, the fact of this absence is an important one because of its bearing on the question of the completeness of the faunal record preserved in the caves.

NESOPHONTES PARAMICRUS sp. nov.

Plate 1, fig. 1

Type.—Skull, lacking postero-inferior portion of occiput; the following teeth in place: pm^2, pm^4, m^1 and m^2 of right side, m^1 and m^2 of left side. No. 253063, U. S. Nat. Mus. Collected at front of large cave near St. Michel, Haiti, March, 1925, by Gerrit S. Miller, Jr.

Diagnosis.—Size and general characters of skull and teeth as in the Cuban *Nesophontes micrus* G. M. Allen. Upper molars without the well-defined sulcus which, in *N. micrus*, lies between the base of metacone and posterior commissure of protocone; lower molars with metaconid and entoconid obviously less nearly terete than in the Cuban animal.

Skull.—The skull appears to be similar to that of *Nesophontes micrus*.

Teeth.—As compared with those of *Nesophontes micrus* the larger maxillary teeth are more robust in general form, a character resulting from the less rapid narrowing of the base of the protocone toward the lingual side of the tooth crown. This peculiarity is especially evident in m^1 and m^2, but it is also visible in pm^4. This general tendency toward robustness of the cusps appears to be responsible for the main dental peculiarity by which the Haitian and Cuban members of the genus are distinguished from each other. In *Nesophontes micrus* there is always present, up to the time when this portion of the crown is destroyed by wear, a distinct and often wide notch at the point where the posterior margin of the protocone joins the base of the metacone. In *N. paramicrus* the bases of the two cusps are so large and well filled-out that they come together directly and smoothly or with at most a faintly developed intervening transverse crease. The same general features are present in the mandibular teeth, where the cusps show a uniform tendency to be heavier and less nearly terete than in the Cuban animal, characters best appreciated on comparison of the mataconid and entoconid of the two species. The heels of the lower molars are quadrangular (longer than broad) rather than squarish in outline and the bottoms of the central convexities tend to be rather broadly rounded instead of narrowly infundibuliform.

Measurements.—Type: greatest length, 32.4±; palatal length, 15.0; glenoid breadth, 12.4; interorbital breadth, 7.4; palatal breadth including molars, 9.2; front of canine to back of m^3, 12.2; four molariform teeth (alveoli), 7.2.

Specimens examined.—Skulls, 2; left maxilla, 1; mandibles, 18; humeri, 9; femora, 10; innominate, 1.

Remarks.—This species is sharply differentiated from the Porto Rican *N. edithæ* by its much smaller size, and from the Cuban *N. micrus* by the peculiarities of its teeth.

NESOPHONTES HYPOMICRUS sp. nov.

Plate 1, fig. 2

Type.—Nearly perfect skull (lacking auditory parts, incisors, canines and right median premolar) No. 253077, U. S. Nat. Mus. Collected in the deep cave near the Atalaye plantation, Haiti, March, 1925, by Gerrit S. Miller, Jr.

Characters.—Like *Nesophontes paramicrus* but constantly smaller (see pl. 1 and detailed comparisons under "remarks"); triangular outline of m^1 and m^2 in palatal aspect narrower; heels of mandibular molars shorter, their concavities narrowly funnel-shaped at base as in *N. micrus*.

Skull.—Except for its smaller size the skull appears to be essentially similar to that of *N. paramicrus*.

Teeth.—The upper teeth in four individuals differ constantly from the two specimens of *N. paramicrus* in the narrower triangular outline of the crowns of m^1 and m^2. In the mandibular teeth the heel of each molar is shorter, though this character is usually more pronounced in m_1 and m_2 than in m_3.

Measurements.—Type: greatest length, 27.6; condylobasal length, 26.8; palatal length, 12.8; glenoid breadth, 10.6; interorbital breadth, 5.8; palatal breadth including molars, 7.2; depth of braincase (median), 6.4; fronto-palatal depth behind molars, 5.2; front of canine to back of m^3, 9.8; four molariform teeth (alveoli), 6.0.

Specimens examined.—Skulls, 4; left maxilla, 1; mandibles, 24; humerus, 1; femora, 6; innominates, 3.

Remarks.—That the original series of *Nesophontes* skulls from Porto Rico presents a range of variation in size which is unprecedented among other dilambdodont insectivores is well known. This fact has been attributed to sexual dimorphism and as such has been made a part of the diagnosis of the family *Nesophontidæ* (see Anthony, Mem. Amer. Mus. Nat. Hist., n. s., Vol. 2, p. 365 "June" = October 12, 1918; Bull. Amer. Mus. Nat. Hist., Vol. 41, pp. 633, 635, December 30, 1919). The same conditions, though less well marked, were noticed by Anthony in a series of 33 skulls and 150 mandibles of the Cuban *Nesophontes micrus* (Bull. Amer. Mus. Nat. Hist., Vol. 41, p. 633, December 30, 1919). Through Mr. Anthony's kindness I have had the opportunity to examine the entire series of *Nesophontes* jaws in the American Museum of Natural History, and as the result of this examination I am convinced that the differences in size shown by the Cuban and Porto Rican series are probably not due to the same causes as those which have produced the analogous differences that occur in the Haitian material.

Among 26 jaws of the Porto Rican *Nesophontes edithæ* in sufficiently good state of preservation to give the two most important measurements, namely, distance from articular process to anterior face of first molar, and depth through coronoid process, these vary from 16.2 to 22.2 mm. and from 9.0 to 13.2 mm. respectively. This

is an unusually wide range of variation, but the steps by which it is accomplished are so small and the numbers of individuals are so evenly spaced along the series that the measurements present no features which suggest the inclusion of two species. The same is true of 48 jaws of the Cuban *Nesophontes micrus*. Here the range of variation in length from articular process to front of m_1 is from 12.2 to 14.6 mm. and that in coronoid depth is from 6.0 to 8.8 mm. One individual (teeth slightly worn) appears to be abnormally small, with the measurements 11.0 and 5.8 respectively; but apart from this exception the variations are remarkably uniform, and again there is nothing to suggest anything else than purely individual variation.

The series of 42 jaws from Haiti, in striking contrast, is readily separable into two lots on the basis of either one of three different measurements:[1] (a) distance from articular process to front of m_1, larger form (13 specimens), 13.2-14.0, smaller form (18 specimens), 10.0-11.6; (b) depth through coronoid process, larger form (15 specimens), 7.6-8.8, smaller form (17 specimens), 6.0-7.0; (c) combined length of m_1 and m_2, larger form (12 specimens), 4.50-4.85, smaller form (20 specimens), 3.70-3.85. The teeth in the smaller form are definitely reduced in size as compared with those of the larger individuals, a character which is immediately appreciable on comparison of specimens. In the Cuban and Porto Rican series the teeth tend to remain more constant throughout the series. Therefore in those smaller Cuban jaws which approach in size the maximum of the smaller Haitian form the teeth are obviously larger than in the latter. Finally there is no difference in the structure of the heel in the teeth carried by the large and small Porto Rican or Cuban jaws, while in the Haitian specimens an obvious difference is present.[2] Turning now to the skull and the maxillary dentition we find that the contrasts in size between the extremes of specimens from Cuba is about the same as that seen in those from Haiti. The teeth from Cuba, however, are alike in form from the largest to the smallest of 13 specimens, while in those from Haiti there is an obvious difference in the form of the triangular crown outline in the two largest as compared with five others. A final interpretation of these facts must await the

[1] Owing to the fact that some of the mandibles are imperfect it is impossible to obtain all three measurements from every individual.

[2] This is so constant that I made only one error in identifying, by this character alone, 26 jaws (18 *hypomicrus* and 8 *paramicrus*) submitted to me one at a time by an assistant. The specimens were examined under a magnifying power with which I was unfamiliar, this having the effect of destroying all sense of relative size.

accumulation of much more abundant material; but it now appears obvious that the variation in Haitian *Nesophontes* is different in character from that which is presented by the members of the genus occurring in Porto Rico and Cuba, and that the course which does least violence to probability may be followed by recognizing two species among the larger Haitian specimens, separated from each other by absolute differences in size and by easily appreciable structural characters of both maxillary and mandibular molar teeth, a condition which is not known to be due to sexual dimorphism in any insectivore.

NESOPHONTES ZAMICRUS sp. nov.

Plate 1, fig. 3

Type.—Anterior part of skull with complete palate (teeth lacking except pm^2 left and the molariform teeth of both sides) No. 253090, U. S. Nat. Mus. Collected in large cave near St. Michel, Haiti, March, 1925, by Gerrit S. Miller, Jr.

Characters.—Size much less than in any hitherto known member of the genus; palatal length, 10.6; four largest maxillary teeth, 5.0; four largest mandibular teeth, 5.6.

Skull.—Except for their smaller size the two imperfect skulls of this animal do not show any appreciable characters by which they can be distinguished from those of *Nesophontes hypomicrus*. The type gives the impression of greater slenderness, but this may be due to its small actual size. The ratio of palatal width to palatal length in the type is 54.7 and of palatal depth (at posterior margin) to palatal length is 37.7. In both of the two skulls of *M. hypomicrus* these ratios are 55.4 and 40 respectively, a difference which appears to be within the limits of reasonably looked-for individual variation. A greater difference is seen in the ratio of length from hamular process to depth including hamular process: 39.3 in *N. zamicrus*, 42.7 in *N. hypomicrus*. Still greater is that between the ratio of rostral width at level of canine to palatal length: 24.5 in *N. zamicrus*, 30.7 in *N. paramicrus*. Whether or not these peculiarities are anything more than individual is a question which must for the present remain open.

Teeth.—The teeth, except for their smaller size, resemble those of *Nesophontes hypomicrus* in all the characters which distinguish this animal from *N. paramicrus*.

Measurements.—Type: palatal length, 11.0; glenoid breadth, 7.8; interorbital breadth, 5.0; palatal breadth including molars, 5.8; front of canine to back of m^3, 8.2; four molariform teeth (alveoli), 5.0.

Two mandibles: articular process to front of m_1, 9.0 and 8.8; depth through coronoid process, 4.8 and 4.6; four molariform teeth (alveoli), 5.2 and 5.2.

Specimens examined.—Anterior portion of skull, 1 (type); median portion of skull (rostrum broken away at level of pm^4), 1; mandibles, 2; humerus, 1.

Remarks.—In their extremely small size the specimens which I refer to *Nesophontes zamicrus* are sharply set off from all the other material which I have examined. In the type and one mandible the teeth are just beginning to wear; in the second skull and second jaw the process is distinctly more advanced. The series of *N. hypomicrus* includes individuals representing exactly the same stages but showing no approach to the diminutive size of the smallest animal.

CHIROPTERA

Many bones of bats occur in the deposits. While some of these must have come from individuals which inhabited the caves and died there, most of them were probably dropped in owl pellets. The species are all, with one exception, known to be present inhabitants of the island. The one exception is a local form of a genus not hitherto found living elsewhere than in Cuba. There is no reason to suppose that it is extinct in Hispaniola.

CHILONYCTERIS PARNELLII PUSILLUS G. M. Allen

One skull from owl pellets in the cave at Diquini.

MORMOOPS BLAINVILLII CINNAMOMEA (Gundlach)

Three skulls from the larger cave near St. Michel. All in superficial deposit, one of them in a fresh owl pellet.

MACROTUS WATERHOUSII WATERHOUSII Gray

Three skulls and five mandibles from the large cave near St. Michel. One mandible from the small cave. All in superficial deposits. Four skulls from owl pellets in the cave at Diquini.

MONOPHYLLUS CUBANUS FERREUS Miller

A skull, lacking all the teeth except m^1 right and pm^4 and m^1 left, was found among the owl pellet material from the cave at Diquini.

This specimen is unique among the many skulls of *Monophyllus* which I have examined in possessing the well-developed alveolus of a

simple premolar immediately behind the alveolus of the canine. The cavity is closely crowded between the alveolus of the canine and that of the anterior root of the normal anterior premolar. Its diameter is about .25 mm. In other respects the skull does not differ appreciably from those collected by Dr. W. L. Abbott at Jérémie.

Measurements.—Greatest length, 21.4; condylobasal length, 20.0; zygomatic breadth, 9.0; breadth of braincase, 8.8; postorbital constriction, 4.0; breadth of rostrum across alveoli of canines, 3.8.

BRACHYPHYLLA PUMILA Miller

One skull from the steep cave near the Atalaye plantation. Its measurements are as follows: greatest length, 28.0; condylobasal length, 26.8; zygomatic breadth, 15.8; lacrimal breadth, 9.0; postorbital constriction, 6.2; breadth of braincase, 12.2; depth of braincase at middle, 9.6; mandible 19.0; maxillary toothrow (alveoli), 9.2; greatest width of palate including molars, 10.4; mandibular toothrow (alveoli), 10.2. This specimen and the two originally collected by Dr. W. L. Abbott near Port-de-Paix shows that the Haitian *Brachyphylla* is readily distinguishable from the large form inhabiting Porto Rico. From the small Cuban *B. nana* it appears to differ in slightly less reduced size, broader rostrum and palate, and larger molars.

ARTIBEUS JAMAICENSIS JAMAICENSIS Leach

Seven mandibles from the large cave near St. Michel, six skulls and nine mandibles from the deep cave near the Atalaye plantation and three skulls from owl pellets in the cave at Diquini.

A large colony occupied the crooked cave in the group near the Atalaye plantation. When disturbed by the noise made by workmen digging in the cave floor the bats soon took refuge in small holes in the roof, where they remained almost completely hidden. On one occasion a half-grown young, unable to fly, fell from a roof cavity to the ground near where we were excavating. As it lay helpless it uttered chirping, bird-like cries. Immediately the air was filled with dozens of plunging and rising adult bats behaving in the manner of a flock of terns hovering over a wounded companion. Not one of them actually touched the young animal, and the confusion soon subsided, the adults retiring again to their holes.

PHYLLOPS HAITIENSIS (J. A. Allen)

Ten skulls, one left maxilla, 7 mandibles from the large cave near St. Michel; one skull from the deep cave and one mandible from the

crooked cave near the Atalaye plantation. One skull from owl pellets in the cave at Diquini. The skulls were found at all levels from the surface downward to a depth of about two feet.

EROPHYLLA SANTACRISTOBALENSIS (Elliot)

One skull and two mandibles from the large cave near St. Michel; two skulls and three mandibles from the deep cave near the Atalaye plantation. The skulls exactly resemble three collected in a cave near Port-de-Paix by Dr. W. L. Abbott.

In cranial characters this species resembles *Erophylla bombifrons* of Porto Rico and differs notably from the Cuban *E. sezekorni* and its relatives *E. syops* of Jamaica and *E. planifrons* of the Bahamas. The close correspondence in size between the skulls of *E. santacristobalensis* and *E. bomifrons* is shown by the following measurements of the three best Haitian specimens (a) compared with those of three skulls from Porto Rico (b): greatest length, (a) 24.0, 23.4, 23.4, (b) 24.0, 24.2, 24.4; condylobasal length, (a) 22.2, 22.0, 22.0, (b) 22.2, 22.4, 22.4; breadth of braincase, (a) 9.6, 10.0, 10.0, (b) 10.0, 10.4, 10.0; postorbital constriction, (a) 4.6, 4.4, 4.6, (b) 4.4, 4.6, 4.6; breadth of rostrum at base of canines, (a) 5.0, 5.0, 4.8, (b) 5.0, 5.2, 5.0; median depth of braincase, (a) 8.4, 8.0, 8.0, (b) 8.0, 8.2, 8.2. Comparison of specimens shows that the rostrum in the Haitian animal is smaller relatively to the braincase than it is in *Erophylla bombifrons*, and further material will undoubtedly demonstrate the specific distinctness of the two animals.

PHYLLONYCTERIS OBTUSA sp. nov.

Type.—Imperfect skull No. 253095, U. S. Nat. Mus. Collected in the crooked cave near the Atalaye plantation, about four miles east of St. Michel, Haiti, March, 1925, by Gerrit S. Miller, Jr.

Characters.—Like the Cuban *Phyllonycteris poeyi* but incisive foramina smaller and anterior border of premaxillaries as viewed in palatine aspect less narrowly curved.

Skull and teeth.—The size of the skull is essentially as in *Phyllonycteris poeyi*, though the average may prove to be above that in the Cuban animal when it is possible to compare adequate series of specimens. The structure of the anterior part of the palate is alike in the three specimens examined, and is not duplicated by any among the large number of Cuban skulls with which I have compared them. Taking the width of the palate between the incisors and canines as

100, the length of this region from front of premaxilla to posterior border of foramina averages about 82 in *Phyllonycteris poeyi*, while in the three specimens of *P. obtusa* it is only 56.6, 58, and 59.5, respectively. The curve of the anterior premaxillary border of the palate forms part of a circle which, if completed posteriorly, would pass close behind the foramina in *P. poeyi*, but in *P. obtusa* it would be so much larger that the hinder edge of the foramina would scarcely extend beyond its center. The mandible and the molars, both maxillary and mandibular, do not differ appreciably from those of *P. poeyi*. Other teeth lost.

Measurements.—Type and specimen from Diquini (No. 253096): greatest length, —, 22.2; palatal length, 10.0, 10.2; back of glenoid process to front of premaxillary, 17.2, 16.8; breadth of braincase, —, 10.2; postorbital constriction, 5.6, 5.4, width of palate including molars, 7.2, 7.0; mandible, —, 15.4; maxillary toothrow (alveoli), 7.0, 7.2; mandibular toothrow (alveoli), —, 8.0.

Specimens examined.—A skull and mandible from the crooked cave near the Atalaye plantation, a skull from a cave near Port-de-Paix (Dr. W. L. Abbott), and a skull from owl pellets found in the cave at Diquini.

Remarks.—Unlike its relative *Erophylla* the Haitian *Phyllonycteris* is not particularly like the Porto Rican member of its genus. As Anthony figures (Mem. Amer. Mus. Nat. Hist., n. s., Vol. 2, pl. 60, fig. 12) and describes the Porto Rican *P. major* it is a larger animal with relatively small teeth; palatal length ranging from 10.6 to 11.1, but with a toothrow of only 6.7 to 6.8.

EPTESICUS HISPANIOLÆ Miller

TADARIDA MURINA (Gray)

One mandible of each of these small bats was collected in the large cave near St. Michel.

RODENTIA

Bones of native rodents representing six genera, only one of which is known to have a living species, form the great mass—probably more than 95 per cent—of all the deposits. Mingled with them are the remains of the large owl, *Tyto ostologa*, which brought them to the caves. It is easy to realize that the existence of a bird of this type might depend so entirely on an abundant rodent food supply that, with the gradual disappearance of the large indigenous rodents, the owl must also have become extinct, leaving the caves to the small

Tyto glaucops capable of subsisting on introduced rats and mice, and on the native bats, lizards and small birds. Beneath a ledge in one of the caves near St. Michel I found pellets of the small owl on the surface, and, at a depth of from eighteen inches to two feet, compactly moulded masses of extinct rodent bones, evidently parts of the pellets of the extinct bird which once used this same resting place.

BROTOMYS VORATUS Miller

Plate 2, fig. 1

Two imperfect skulls and 52 mandibles. These specimens represent all the caves worked in with the exception of the deep cave near the Atalaye plantation.

The skulls essentially agree with the type, from the Dominican Republic. The mandibles, when compared with specimens of *Boromys offela* and *B. torrei* collected in Cuba by William Palmer in 1917 show no striking peculiarities. In both species of *Boromys*, however, the masseter ridge on the outer side of the mandible is so developed that, in the region beneath m_2, its upper surface projects almost at a right angle to the outer surface of the mandible above it, while its extreme edge in some specimens is slightly turned upward. In *Brotomys* the upper surface of the ridge slopes obliquely downward and the margin is not upturned.

The three genera *Brotomys*, the Cuban *Boromys*, and the Porto Rican *Heteropsomys* are at once distinguishable from the other native Antillean rodents by their relatively low crowned, long rooted, subterete cheekteeth. All three are intimately related and it may eventually be found expedient to unite them under one name. For the present, however, it seems preferable to regard them as distinct from each other. The additional material now at hand makes it possible to define their differences as follows:

Posterior termination of incisor root visible behind anterior base of zygoma when skull is viewed from below; antorbital foramen relatively small, its height much less than length of toothrow.....*Heteropsomys*.
Posterior termination of incisor root not visible behind anterior base of zygoma when skull is viewed from below; antorbital foramen relatively large, its height nearly equal to length of toothrow.
A deep neural channel on floor of antorbital foramen; posterior termination of incisor root marked by an obvious swelling....*Boromys*.
No definite neural channel on floor of antorbital foramen; posterior termination of incisor root not marked by an obvious swelling .....*Brotomys*.

BROTOMYS (?) CONTRACTUS sp. nov.

Plate 2, fig. 2

Type.—Anterior portion of skull, lacking zygomata, nasals and teeth, No. 253100, U. S. Nat. Mus. Collected in small cave near St. Michel, Haiti, March, 1925, by Gerrit S. Miller, Jr.

Characters.—Resembling *Brotomys voratus*, but size slightly less, rostrum relatively shorter, interorbital region narrower in proportion to frontopalatal depth and more arched transversely; teeth broader than in *Brotomys voratus*, and palate noticeably constricted, its interalveolar width at middle conspicuously less than transverse diameter of the adjoining alveoli.

Skull.—While resembling in a general way that of *Brotomys voratus* the skull of *B.* (?) *contractus*, even in the imperfect condition of the only known specimen, shows well marked differential characters. Most conspicuous among these is the narrowness of the bony palate as compared with the very wide alveoli of the anterior cheekteeth. In three specimens of *B. voratus* (the type from the Dominican Republic and two from Haiti) the width of the palate between the alveoli of the second cheekteeth is 2.55, 3.0 and 3.0, respectively, and the width of the first alveolus is 2.25, 2.25 and 2.30. In the type of *B.* (?) *contractus* the width of the palate at the same level is only 1.65, while that of the first alveolus is 3.60. The narrowing of the skull shown by the palate is also evident when the interorbital breadth is compared with the fronto-palatal depth. In the type of *Brotomys* (?) *contractus* the ratio of this breadth (15.6) to depth (13.0) is only 83.3, while in the three specimens of *B. voratus* it is 92.5, 90.0 and 92.6. The greater transverse convexity of the interorbital roof is a character which cannot be expressed by measurements; it is immediately obvious when specimens are compared in posterior view. Because of the imperfect condition of the skull a comparison of the length of the rostrum with anything but the length of the palate is difficult; hence the apparent shortening of the rostrum may be due in part to an actual lengthening of the palate to accommodate the enlarged teeth. In *Brotomys* (?) *contractus* the length of the palate (9.4) measured from posterior border to level of anterior margin of alveolus of pm^4 is essentially equal to the distance from the latter level to alveolus of incisor (9.8); in *B.* (?) *contractus* it is barely more than the distance from alveolar level to front of incisive foramina (that is, about 5 mm. less than the distance to alveolus of incisor). The alveolar length of the toothrow in the type of *B.* (?) *contractus* cannot be exactly measured (the alveolus of m^3 is entirely

missing on one side and is incomplete on the other) but it must have been essentially equal to the diastema (10.8 mm.). In the three skulls of *B. voratus* it is 9.8, 10.0 and 9.6, while the diastema in the same specimens is 13.6, 12.6 and 12.8, respectively.

Specimens examined.—One, the type.

Remarks.—The disproportion between the alveoli and palate in this species as compared with *Brotomys voratus* is so great as to suggest that, when more completely known, the animal will prove to represent a distinct genus. In all of the other related members of the group from the large *Heteropsomys* (and *Homopsomys* if distinct) of Porto Rico to the small *Boromys torrei* of Cuba the proportionate width of palate and alveoli does not greatly vary; the palate, at the m^1 level is always at least equal to the width of the largest alveolus. The narrowing of the palate to less than half the width of this alveolus in *B.* (?) *contractus* may therefore easily be a character of more than specific weight.

ISOLOBODON LEVIR (Miller)

Plate 2, figs. 3, 3a

1922 *Isolobodon portoricensis* Miller, Smithsonian Misc. Coll., Vol. 74, No. 3, p. 3, October 16, 1922.

1922 *Ithydontia levir* Miller, Smithsonian Misc. Coll., Vol. 74, No. 3, p. 5, October 16, 1922.

Thirty palates and fragmentary skulls, more than 600 mandibles.

This is the most abundantly represented of the vertebrates found in the bone bearing deposits. Its flesh seems to have been the chief article of food of the giant barn owl, *Tyto ostolaga;* many of the skulls and jaws were found in masses of bones which had the structure characteristic of owl pellets.

The original collection from the large cave near St. Michel included two isolated upper premolars of *Isolobodon*. Wrongly determining them as lower teeth I made these specimens the basis of a new genus and species, *Ithydontia levir*, selecting as type what I supposed to be "a right mandibular tooth, probably pm_4 or m_1," but actually, as the rich material now at hand clearly shows, pm^4 left. So far as the generic name *Ithydontia* is concerned there can be no doubt—it is a synonym of *Isolobodon*. But the proper disposition of the specific name is less easily determined. For the present it seems necessary to retain *Isolobodon levir* as the designation of the Haitian member of the genus. Although the absence of good skulls from the St. Michel series makes a satisfactory comparison with *Isolobodon portoricensis*

impossible, the smaller size of the Haitian specimens is so constant as compared with material from Porto Rico and the Virgin Islands that the existence of two members of the genus appears to be established. The circumstance must not be overlooked that the Haitian food refuse was accumulated by owls, while that formed elsewhere was chiefly if not entirely deposited by men. It is possible therefore that the difference in size may be partly due to selection of the rodents used as food—the owls tending to capture smaller, more easily devoured individuals, the men preferring the larger ones. That the owls were able to eat animals as large as the largest Porto Rican *Isolobodon* is shown by the frequent presence in the deposits of *Aphætreus* jaws of equally large size. Whatever bearing the possibility of selection may have, the facts are as follows:

Among more than 600 Haitian mandibles the eight largest have toothrows of the following lengths, 16.2, 16.2, 16.2, 16.4, 16.6, 17.0, 17.2 and 17.2 mm., while the extremes of Anthony's measurements of individuals selected from a series of 200 Porto Rican specimens are 17.6 and 19.2 mm. The three longest maxillary toothrows among the Haitian specimens selected for large size are 16.2, 16.2 and 17.0 mm.; Anthony gives 17.2 to 19.3 mm. as the range of variation among adults in his series of 17 skulls. The interorbital breadth can be measured accurately or approximately in seven of the Haitian skulls. It ranges from 15 mm. to about 18 mm.; Anthony's extremes are 19.8 and 23.5 mm. in six skulls from Porto Rico. In two Haitian specimens the length of the frontal bone along the median suture is 18.6 mm. and 20.0 mm.; the extremes of eight from Porto Rico are given as 22 mm. and 30 mm., with only three specimens less than 24.5 mm. The breadth of rostrum at premaxillary suture does not exceed 11 mm. in any of 15 Haitian specimens (some of them obviously immature), while in seven from Porto Rico it ranges from 13 mm. to 14.5 mm. Under these circumstances it seems necessary to recognize the Haitian *Isolobodon* as a distinct form.

The status of the *Isolobodon* whose bones have been found in kitchen middens in the Dominican Republic is a matter of special interest now that it becomes impossible to regard the Haitian member of the genus as identical with *I. portoricensis*. I once said that there appears to be no way to distinguish between Dominican, Porto Rican and Virgin Island specimens;[1] and after going over the ground again in the present connection I am of the same opinion. A palate from San Pedro de Macoris, Dominican Republic, is broken in such a

[1] Proc. U. S. Nat. Mus., Vol. 54, p. 508, October 15, 1918.

manner that the toothrow cannot be measured, but the alveolar length must have been at least 18 mm.; enough of the base of the rostrum is preserved to show that the breadth at premaxillary suture was more than 13 mm. In three mandibles from the same locality the toothrow measures 17.6, 18.6 and 18.6 in contrast to the maximum of 17.2 for the entire series of over 600 jaws from the Haitian caves. Of two mandibles collected by Gabb at San Lorenzo Bay one has a toothrow 18.8 mm. in length, while in the other, an obviously younger individual, it is 16.8, only a little below the maximum for the Haitian specimens.

APHÆTREUS MONTANUS Miller

Plate 2, figs. 4, 4a, 4b

Seventeen imperfect skulls and palates, 208 jaws.

In both groups of caves the remains of this animal were common, the frequency of their occurrence coming next after that of *Isolobodon levir*.

The material at hand makes it possible to define the genus more completely than I was able to do in the original paper. It is now evident that the genera *Aphætreus*, *Isolobodon* and *Plagiodontia* form a rather compact group, the members of which are more nearly related to each other than any one of them is to *Capromys* and its allies. In all three the enamel pattern of the upper molars is tetramerous; in *Plagiodontia* the upper premolar has reached the same stage of simplification, but in *Aphætreus* and *Isolobodon* this tooth retains a small fifth element. The maxillary teeth of *Capromys* and *Geocapromys* are all pentamerous. In the *Isolobodon* group the direction of the inner reentrant fold is diagonally forward in the upper teeth, backward in the lower teeth; the reverse is the case in *Capromys*. The general structure of the crowns in the *Capromys* group parallels that which has been developed by the voles; this is not true with regard to *Isolobodon* and its allies. The characters of the three genera may be tabulated as follows:

Curve of upper incisor short, the root of the tooth lying at anterior margin of zygomatic process of maxillary; lower incisor terminating beneath m_3; pm^4 with one outer reentrant angle, its enamel pattern exactly similar to that of the molars; reentrant folds in upper teeth very oblique, their slant 45° or less as referred to corresponding alveolar line; reentrant folds on inner side of the lower teeth extending less than halfway across crowns; frontal sinus sufficiently inflated to produce an obvious swelling over anterior zygomatic root, to encroach on area of antorbital foramen, and to a less degree on that of orbit; posterior margin of zygomatic process of maxillary lying about in line with anterior alveolar border.....*Plagiodontia*.

Curve of upper incisor long, the root of the tooth lying in antorbital foramen; lower incisor terminating beneath m_3; pm^4 with two outer reentrant angles, its enamel pattern obviously different from that of the molars; reentrant folds in upper teeth not very oblique, their slant more than 45° as referred to corresponding alveolar line; reentrant folds on inner side of lower teeth extending more than halfway across crowns; frontal sinus not sufficiently inflated to produce an obvious swelling over anterior zygomatic root or to encroach on area of antorbital foramen or of orbit; posterior margin of zygomatic process of maxillary lying at or behind level of middle of alveolus of pm^4.

Opposed inner and outer reentrant angles of all teeth remaining distinct throughout life, the enamel pattern of each tooth entire; crowns and alveoli of both upper and lower molars nearly as long as wide ..... *Isolobodon.*

Opposed inner and outer reentrant angles of all teeth becoming confluent in adults, the enamel pattern of each tooth then divided into two sections; crowns and alveoli of both upper and lower molars conspicuously wider than long ..... *Aphætreus.*

The series of mandibles includes about 30 specimens in which the breaking through of the opposed enamel folds has not yet taken place. Unfortunately there are no sets of upper teeth representing the same stage. In these immature individuals the enamel pattern of the mandibular teeth contains exactly the same elements that are present in the corresponding teeth of *Isolobodon*. The characteristic peculiarities of crown outline are, however, evident at a very early stage, and, though less pronounced than in the adults, they are sufficient to be diagnostic. In harmony with the shorter tooth crowns of *Aphætreus* the enamel folds are narrow as compared with those of *Isolobodon*, and the reentrants are more completely filled with cement. The crowns consequently tend to have a solid, squarish aspect, while in *Isolobodon* they are oblong and always with conspicuous angular emarginations. From the mandibular teeth of *Plagiodontia* those of *Aphætreus* are readily distinguished by the less oblique direction of all the enamel folds, and by the greater length of the outer reentrant, which fold invariably extends more than halfway across the crown, while in *Plagiodontia* it never reaches the middle of the crown.

The maxillary teeth have not hitherto been known. Like the mandibular teeth they contain the same elements that are present in *Isolobodon*, but these elements are compressed in the axis of the toothrow, and the opposed reentrant folds are confluent in adults, thus splitting the enamel pattern into two sections. The region of breaking through in the maxillary teeth is clearly indicated by irregularities in the enamel outline; hence it seems probable that in young individuals it will be found that the pattern is not split.

Two toothless mandibles, not improbably pertaining to one individual, dug from the small available area of original floor material in the caved-in chamber near St. Michel, are unique, among the octodont rodents which I have examined, in the presence of a well developed fifth alveolus behind the normal fourth (pl. 2, fig. 4*b*).

PLAGIODONTIA ÆDIUM F. Cuvier

Seven mandibles (five from the group of caves near St. Michel, the others from the crooked cave near l'Atalaye) are referable to the species represented by the large specimen from San Pedro de Macoris, Dominican Republic, which I have identified (Proc. U. S. Nat. Mus., Vol. 72, Art. 16, pp. 5-6, September 30, 1927) as an individual of the species originally described by F. Cuvier. Only one of the Haitian specimens is fully adult, and in this the coronoid and angular regions are broken off and all the teeth have been lost. Its size must have been almost exactly the same as that of the Macoris jaw. In each the length of the symphysis menti is 27.6 mm. and the distance from the posterior angle of the symphysis to anterior margin of alveolus of pm_4 is 20.4. Among 13 jaws of the recently described Dominican *Plagiodontia hylæum* Miller the maxima for these two measurements are only 25.4 and 19.0, while the usual dimensions in adults are decidedly less, about 24 and 17. The length of the toothrow in the adult Haitian *P. ædium*, 23.4, is only 0.6 mm. less than that in the Macoris specimen; the maximum in the series of *P. hylæum* is 20.6. In two of the younger Haitian individuals, both of them broken off immediately behind the toothrow, the second molar is not yet fully in place. They are, however, distinctly larger and more robust than in two jaws of immature Dominican *P. hylæum*, one with m_2 worn flat but m_3 not in place, the other with all the crowns worn flat. In the five Haitian specimens with teeth the enamel pattern presents the characters which distinguish *Plagiodontia ædium* from *P. hylæum* (see Miller, Proc. U. S. Nat. Mus., Vol. 72, art. 16, p. 4, and pl. 1, figs. 1*c* and 2, September 30, 1927).

PLAGIODONTIA SPELÆUM sp. nov.

Type.—Right mandible of young adult, No. 253160, U. S. Nat. Mus. Collected in the crooked cave near the Atalaye plantation, Haiti, March, 1925, by Gerrit S. Miller, Jr.

Characters.—Resembling *Plagiodontia hylæum* Miller from eastern Dominican Republic but noticeably smaller; length of mandible measured from articular process probably not much exceeding 40 mm.

instead of ranging from about 48 to 54 mm.; mandibular toothrow usually less than 18 mm. instead of ranging from about 18.5 to 20.5 mm. Portion of mandible in front of cheekteeth relatively shorter and more abruptly curved than in *P. hylæum*.

Measurements.—From five jaws which may be regarded as adult I am able to obtain the following measurements: length of mandible from articular process, 39.6, 39±, —, —, —, length of symphysis, 18.0, 18±, 17±, 17.6, —; diastema, 9.0, 9.4, 9±, 8.8, 9.2; depth from alveolar margin to lowermost point of symphysis, 11.2, 11.2, 11.2, 10.8, 11.6; mandibular toothrow (alveoli), 16.2, 16.0, 15.8, 16.0, 15.6; transverse diameter of m_1 (grinding surface), 4.5, 4.5, 4.5, 4.2, 4.4. The same measurements in a mandible of *P. hylæum* which appears to be of exactly corresponding age (No. 239886): length from articular process, 48; symphysis, 21.6; diastema, 11.4; depth 13.0; toothrow, 18.6; width of m_1, 5.3.

Specimens examined.—Fifteen mandibles, all imperfect. Four of these came from the group of caves near St. Michel, the others were found in the crooked cave near the Atalaye plantation.

Remarks.—The small *Plagiodontia* from the St. Michel caves differs conspicuously from the associated large *P. ædium* in size and in the longitudinally compressed cheekteeth. Its affinities are obviously with *P. hylæum* of the Samaná Bay region, the only member of the genus known to be now living. At first sight the jaws of *Plagiodontia spelæum* might be mistaken for immature specimens of *P. hylæum*, but when comparison is made between individuals in corresponding stages of development (as indicated in immature individuals by the eruption of the second and third molars, and in young adults by the gradual disappearing of porousness and surface wrinkling of the bone on the lower side of the jaw beneath the roots of these teeth) the differences between the two species become obvious.

HEXOLOBODON gen. nov.

Plate 3, figs. 1, 1a, 1b

Type.—Hexolobodon phenax sp. nov.

Characters.—So far as known most like *Geocapromys*, but differing as follows: cheekteeth with roots becoming closed at or soon after the stage when the crowns are worn flat; root of lower incisor passing beneath root of m_3 and terminating, in fully adult individuals, on outer side of toothrow beneath the floor of the groove which separates the alveolus of m_3 from the base of the coronoid process; pm_4 (pl. 3, fig. 1*a*) with only two reentrant angles on inner side (as in *Capromys*);

all of the maxillary teeth with two about equally developed reentrant angles on each side, these imparting to the crowns an evenly six-lobed structure (pl. 3, fig. 1).

Remarks.—In the general structure of the palate and the relationship of the incisor roots to those of the premolars this genus is practically identical with *Geocapromys*. The roots of the premolars come close together in the median line, where they are overgrown by the maxillary exactly as in *Geocapromys*. The roots of the premolars with their covering of bone fill up the lower part of the narial channel in the region between the incisor roots (pl. 3, fig. 1*b*). A broken palate without teeth could be distinguished by this character alone from a similar fragment of a *Capromys* or *Plagiodontia* skull, in both of which the anterior part of the narial channel is widely open between the roots of the premolars (pl. 3, fig. 2), but might be confused with a similar fragment pertaining to a member of the genera *Geocapromys, Isolobodon,* or *Aphætreus*.

In *Geocapromys* and *Capromys* (pl. 3, fig. 2) the roots of all four cheekteeth, when exposed by cutting or breaking away their bony covering, are seen to be about evenly spaced in the toothrow—at most the septum between the roots of pm^4 and m^1 is slightly thicker than the septa between the molars. In *Hexolobodon,* on the contrary (pl. 3, fig. 1*b*), the root of the premolar is thrown conspicuously forward away from that of the first molar.

The less specialized condition of the roots of the cheekteeth and the extension of the lower incisor root to the outer side of the mandibular toothrow are characters which, like the enamel pattern of the upper teeth, sharply differentiate this genus from its Antillean relatives *Capromys, Geocapromys, Plagiodontia, Aphætreus,* and *Isolobodon*.

HEXOLOBODON PHENAX sp. nov.

Plate 3, figs. 1, 1a, 1b

Type.—Palate with complete dentition of immature individual (m_3 with only anterior half of crown worn flat), No. 253118, U. S. Nat. Mus. Collected in the small cave near St. Michel, March, 1925, by Gerrit S. Miller, Jr.

Characters.—An animal about the size of *Capromys pilorides,* but skull probably differing from that of all species of *Capromys* and *Geocapromys* in shorter rostrum and generally more robust form. With regard to features which are not obviously generic, such exact comparisons with *Capromys pilorides* as the fragmentary remains of

the extinct animal will permit, are as follows: palate in region between pm^4 and maxillo-premaxillary suture much smaller relatively to grinding area of toothrow (about 10 x 14 mm. as compared with 13 x 18 mm. in a specimen of *C. pilorides* with grinding area of toothrow of essentially the same length and breadth as that of the type), its upward slope more abrupt; no obvious pit for attachment of the maxillo-nasolabialis muscle in region between pm_4 and incisive foramen (these pits are visible in all the living species of *Capromys* and *Geocapromys;* they are not developed in *Isolobodon, Aphætreus* or *Plagiodontia*); posterior emargination of palate extending forward slightly beyond level of posterior border of m^2 instead of about to middle of m^3; narrow inferior maxillary zygomatic root, its width through middle of specialized muscle-insertion area considerably less than width of grinding surface of molars instead of distinctly greater than width of this surface. The upper toothrows are more convergent than in *Capromys pilorides,* so that the bony palate becomes reduced anteriorly to a width only about one-fifth that of the adjoining alveolus or of its own width posteriorly. In *C. pilorides* the anterior width of palate is considerably more than half that of alveolus and almost exactly half of its own posterior width. Posterior emargination of palate extending slightly beyond level of septum between alveoli of m^3 and m^2. All of the mandibles are broken immediately behind the toothrows. In the portion which remains there are several obvious peculiarities as compared with the corresponding region in *Capromys pilorides.* The diastema is short and more abruptly concave when viewed from the side. The symphysis is conspicuously shorter than in *C. pilorides* and its long axis is set at a higher angle to the plane of the grinding surface of the molars; about 50° instead of about 35°. The anterior portion of the ridge which extends forward along the outer side of the mandible from the angular process is heavier and more evenly rounded than in the Cuban animal. The enamel pattern of the mandibular teeth appears to be not positively distinguishable from that of *Capromys pilorides.*

Measurements.—Type: distance from posterior surface of m^3 to anterior border of maxillary directly in front of toothrow, 30.0 (35.0);[1] distance from posterior margin of incisive foramen to posterior margin of palate, 24.6 (26.2); distance from alveolus of pm^4 to anterior edge of maxillary, 9.4 (13.2); width of bony palate through

[1] Measurements in parenthesis are those of a similarly broken palate of a slightly older individual of *Capromys pilorides* from Sierra La Guira, Pinar del Rio, Cuba (No. 253232, U. S. Nat. Mus.).

anterior edge of posterior emargination, 5.6 (8.2); least width of palate between toothrows, 1.2 (4.0); maxillary toothrow (alveoli) 22.0 (22.4); alveolar width of pm^4, 5.8 (5.2); height of m^1 from grinding surface to root, 15.0 (14.0). Mandible of an individual with teeth in same stage of wear as those of type: distance in alveolar line from posterior margin of m_3 to anterior margin of incisor, 36.0; distance from tip of incisor to posterior edge of grinding surface of m_3, 38.0; diastema, 10.0; distance from tip of incisor to anterior margin of crown of pm_4, 15.8; depth from inner margin of alveolus of pm_4 to posterior point of symphysis, 14.4; length of symphysis, 22.4; length of toothrow, grinding surface, 22.2, alveoli, 24.0; alveolar width of pm_4, 5.8. Mandible of an individual with crown of m_3 entirely worn flat: distance in alveolar line from posterior margin of m_3 to anterior margin of incisor, 37± (46.6);[1] diastema, 11± (18.8); depth from inner margin of alveolus of pm_4 to posterior point of symphysis, 17± (19.0); length of symphysis, 23± (23.0); length of toothrow, grinding surface, 24.2 (22.0); alveoli, 25.0 (22.4); alveolar width of pm_4, 5.4 (5.0).

Specimens examined.—One palate, six mandibles and four isolated cheekteeth. A mandible and two of the isolated teeth were found in the caves near l'Atalaye, the rest of the material came from the large and small caves near St. Michel.

QUEMISIA gen. nov.

Plate 4, figs. 2, 2a

Type.—*Quemisia gravis* sp. nov.

Characters.—Size and general features probably as in the Porto Rican *Elasmodontomys*. Enamel pattern of mandibular cheekteeth (pl. 4, fig. 2*a*) like that of *Elasmodontomys* (pl. 4, fig. 1*a*) but reentrant folds less transverse to the axis of the toothrow, the axis of the folds slanting forward at an angle of only 21° instead of about 50°. Mandibular symphysis extending backward beyond level of middle of m_1 instead of barely to middle of pm_4; shaft of lower incisor not extending behind symphysis, its base lying beneath anterior half of m_1 (in *Elasmodontomys* the shaft of the incisor extends far beyond the symphysis to terminate beneath middle of m_2); shaft of femur more flattened than in *Elasmodontomys*.

[1] Measurements in parenthesis are those of an adult *Capromys pilorides* (No. 143150).

Remarks.—The genus *Quemisia* is a member of the group which is represented by *Elasmodontomys* in Porto Rico and *Amblyrhiza* in Anguilla. The cheekteeth in all three of these genera are very hypsodont but not ever-growing. The enamel pattern is pentamerous with the inner reentrant fold of the upper teeth (in *Amblyrhiza* and *Elasmodontomys,* at least) and the outer fold of the lower teeth passing behind the posterior outer reentrant. All of the reentrant folds penetrate nearly or quite across to the opposite side of the crown, thus producing a grinding surface which consists of a series of essentially parallel transverse enamel ridges.

The most striking known peculiarities of *Quemisia* are the long mandibular symphysis, short lower incisor, and the very unusual forwardly-directed enamel folds in the lower teeth. I have chosen the name because of my belief that the animal is probably the "Quemi" of Oviedo (Hist. Gen. et Nat. de las Indias, Madrid, 1851, p. 389).

QUEMISIA GRAVIS sp. nov.

Plate 4, figs. 2, 2a

Type.—Mandible of immature individual (m_3 with crown not yet in place), No. 253175, U. S. Nat. Mus. Collected in the crooked cave near the Atalaye plantation, March, 1925, by Gerrit S. Miller, Jr.

Characters.—As compared with a mandible of *Elasmodontomys obliquus* in corresponding stage of tooth growth the type specimen of *Quemisia gravis* shows many peculiarities in addition to those which have already been described. The depth of the horizontal ramus at middle of m_1 is greater in proportion to the length of the toothrow (21.5:33 instead of 18:34); the maximum width through the symphysis is greater (17.5 instead of 11) a difference occasioned partly but not wholly by the more posterior point of termination of the symphysis in the Haitian animal. The anterior base of the angular process is laterally compressed in *Quemisia,* so that it forms about one-third of the transverse diameter of the mandible; in *Elasmodontomys* it is so thick that it forms considerably more than half of the entire transverse diameter. The roots of the third and fourth cheekteeth extend down into this thickened area in *Elasmodontomys.* In *Quemisia* the roots of the three molars form a broadly curved ridge extending backward and upward from the symphysis and separated from the base of the angular process by a shallow groove; this ridge has, at first sight, something the appearance of the ridge which marks the course of the incisor root in *Elasmodontomys.*

The cheekteeth are open at the base, as in *Elasmodontomys* of the same age; whether or not they eventually become closed as in adult *Elasmodontomys* cannot now be determined. The enamel pattern is fundamentally the same as in *Elasmodontomys,* that is, a pentamerous pattern in which all the reentrant folds have been extended nearly or quite across the crown (the outer fold passing behind the second inner fold). The posterior limb of each fold has been thickened to form a conspicuous enamel plate and the anterior limb of each fold except the first has been reduced to the vanishing stage. As compared with that of the Porto Rican animal the pattern in *Quemisia* shows a mixture of excessive peculiarity and less high specialization. The forward turning of the enamel folds so that the anterior portion of each fold is approximately parallel with the main axis of the toothrow is a specialization of high degree and very peculiar kind. In *Elasmodontomys* there is an indication of this tendency at the front of the premolar, but the direction of the folds in the molars is normal and not essentially different from that seen in *Plagiodontia, Isolobodon* or *Aphætreus.* On the other hand the process of plate specialization has not progressed so far in *Quemisia* as it has in *Elasmodontomys.* While the external reentrant fold has extended completely across the crown in all three of the used cheekteeth neither of the two internal folds has quite reached the enamel of the opposite side in pm_4, and only the first has penetrated so deeply in m_1 and m_2. In each of the molars there is, therefore, one incomplete enamel plate, the second, while in the premolar there are two, the first and second. In *Elasmodontomys* all the folds have crossed the crown in all the teeth, and there are, consequently, no incomplete plates. The peculiar twisting of the enamel pattern almost into the axis of the toothrow in *Quemisia* throws the anterior loop of each tooth over on to the inner side of the crown out of contact with the tooth in front of it. The free face of each of these loops carries a fully developed enamel wall. In *Elasmodontomys* such an enamel wall occurs on the first loop of the premolar only.

A fragment of incisor (apparently an upper tooth) 19 mm. in length has a width of 5 mm. and an antero-posterior diameter of 4.2 mm. at level immediately proximal to the terminal worn area. The anterior face is longitudinally fluted by six obscurely developed ridges and the faint intervening concavities.

A broken femur which I refer without much doubt to this species differs from the corresponding bone in *Elasmodontomys obliquus* in the conspicuous flattening of its shaft. The greatest and least diameters

of the shaft in its narrowest region are 12.2 and 8.2, while in one specimen from Porto Rico they are 10.8 and 8.8, and in another 13.0 and 9.8.

Specimens examined.—Mandible and piece of an incisor from the crooked cave near the Atalaye plantation; broken femur from the small cave of the same group.

XENARTHRA

The occurrence of ground sloths in Hispaniola was not known before the discovery of a few bones in the St. Michel caves by Mr. Brown and Mr. Burbank. On the basis of this scanty material—four vertebræ, three of them imperfect, a piece of a limb bone of a young animal, and a fragment of a rib—I was unable to refer the species to any genus, and, at Doctor Matthew's suggestion, I recorded it[1] as *Megalocnus ? sp. ?*

On visiting the caves myself I secured teeth and a femur resembling the corresponding parts of the Porto Rican *Acratocnus* and also a calcaneum so unlike that of *Acratocnus* as to suggest the existence of two sloths differing generically from each other. The material collected by Mr. Poole now makes the definite separation of these animals possible. One is slender limbed, resembling *Acratocnus* in size and general features; the other is more heavy, its general build probably somewhat as in *Nothrotherium shastense*. Its bulk, however, though considerably exceeding that of *Acratocnus*, is not likely to have been much more than one-fourth that of the Californian animal.

That one or both of these sloths continued to exist on the island until after the advent of man I have no doubt. The facts which have led me to this conclusion are as follows: (a) In the two caves near St. Michel most of the sloth remains were found within two feet of the surface; and human bones and pottery occurred to the same depth without any indication that they had been dug in. (b) Near the entrance to the smaller of the two main caves bones of ground sloths (certainly two and perhaps more individuals) were inextricably mixed with bones of man (adult and infant) and domestic pig. The remains were scattered among the small fragments of limestone which made up the greater part of the floor material, and I was unable to determine any definite level-relationship among them. (c) Near the entrance to the large cave I unearthed with a trowel, in fine, soft, undisturbed material at the bottom of a trench two feet deep, the femur

[1] Smithsonian Misc. Coll., Vol. 74, No. 3, p. 6, October 16, 1922.

of a ground sloth, and, about 18 inches from it, a fragment of coarse dark pottery. There was no evidence of previous digging that I could discover; and the bone and pottery had every appearance of having been deposited on the former surface of the cave floor and subsequently covered by the gradual accumulation of detritus. (d) Both of these caves are situated on the side of a high ridge where the material composing their floors is entirely removed from the action of streams. (e) In general the ground sloth bones were associated with the human remains in exactly the same manner as the bones of *Isolobodon* and *Plagiodontia,* rodents which are positively known to have been contemporary with man.

ACRATOCNUS (?) COMES sp. nov.

Plate 5, fig. 2; plate 6, fig. 2; plate 8, fig. 1; plate 10, fig. 1

Type.—Right femur (lacking distal extremity) of adult, No. 253178, U. S. Nat. Mus. Collected in large cave near St. Michel, Haiti, March, 1925, by Gerrit S. Miller, Jr.

Characters.—A small ground sloth agreeing in general size with the Porto Rican *Acratocnus odontrigonus* Anthony; its weight probably not exceeding 50 pounds. Femur resembling that of the Porto Rican sloth, and, like it, with a well developed lesser trochanter and without noticeable antero-posterior compression of the shaft, but modified for more directly perpendicular weight-bearing.

Femur.—The femur differs from the corresponding bone of *Acratocnus odontrigonus* in at least two features which are important enough to indicate specific or, possibly, generic distinctness. (1) The intertrochanteric ridge is similar in position and development to the corresponding structure in *A. odontrigonus,* but it is supplemented by a large and conspicuous tubercle situated at the middle of the shaft at a level slightly below that of the lesser trochanter. This tubercle, of which no obvious trace exists in the numerous Porto Rican femora with which I have compared the Haitian specimen, forms the culminating point of a general thickening of the bone which imparts to the upper fourth of the shaft, as viewed from the side, a strongly angular-convex profile very different from the flat or slightly concave profile of the same region in *A. odontrigonus* (see pl. 6). (2) The neck is shorter than in *Acratocnus odontrigonus* and is less bent outward and forward from the axis of the upper half of the shaft; as a result, the head is set so as to diverge less noticeably from the general contour of the shaft. The differences in this respect between the Porto Rican and Haitian animals are of the same kind

as those which exist in greater degree between the femora of *Cholœpus* and *Bradypus*. The less anterior directing of the neck in the Haitian femur is perhaps most readily made apparent by applying the proximal extremity of the bone to a flat surface in such a way that it is supported by the tripod formed by the posterior surfaces of the head and the two trochanters. The shaft of the bone in *Acratocnus* (?) *comes* then takes a position essentially parallel with the flat surface. When the femur of *A. odontrigonus* is similarly placed the shaft rises above the flat surface at an angle ranging from about 18° to about 23°. The same difference may be observed by tracing the direction of the low but usually evident ridge which crosses the neck from the head to the lesser trochanter. In *Acratocnus odontrigonus* this ridge extends so obliquely to the inner surface of the femur that its line, when continued downward, passes beyond the contour of the bone at a point situated near the mid portion of the head of the trochanter; in the Haitian specimen it passes out nearly 10 mm. farther down the shaft. The lesser inward bend of the neck is best appreciated by "sighting" down the anterior or posterior surface of the shaft of the bone; it then becomes obvious that the head lies nearer to the main axis in the Haitian specimen than in any of those from Porto Rico.

Remarks.—The femur on which this species is based resembles in all its general characters the corresponding bone of the Porto Rican ground sloths and of the Miocene South American *Hapalops*. The peculiarities which I have described as distinguishing it from the femur of *Acratocnus odontrigonus* separate it equally from the corresponding bone of *Hapalops*, at least so far as can be determined from Scott's figures of three species (*longiceps*, pl. 32, *elongatus*, pl. 41, and *ruetimeyeri*, pl. 42).

Other remains which I refer without much hesitation to *Acratocnus* (?) *comes* are as follows: (a) the proximal two-thirds of a right tibia (pl. 8, fig. 1) not certainly distinguishable from the corresponding part of the tibia of a Porto Rican ground sloth (No. 17711, Amer. Mus. Nat. Hist.); (b) an almost perfect atlas (pl. 10, fig. 1) of the proper size to fit a skull of *Acratocnus odontrigonus;* several caniniform teeth, both upper and lower, agreeing in a general way with those of the same animal; (c) foot bones and ungual phalanges resembling those of the Porto Rican species.

On the basis of the femur and of the parts which appear to be almost certainly associated with it I do not now feel justified in separating the small Haitian ground sloth more than specifically from *Acratoc-*

nus odontrigonus. It would cause no surprise, however, if further material should indicate that the animals were generically distinct.

The name *comes* alludes to the circumstance that the type specimen was found so closely associated with fragments of pottery as to lend strong support to the belief that the animal existed in Haiti as a contemporary of man.

PAROCNUS gen. nov.

Plate 7; plate 8, fig. 2; plate 9; plate 10, figs. 2, 3

Type.—*Parocnus serus* sp. nov.

Characters.—Femur differing from that of *Acratocnus* in the absence of the lesser trochanter; in the conspicuous widening and flattening of the upper half of the shaft; and in the more nearly vertical set of the head (as indicated by the line of the epiphyseal suture in an immature individual), a condition which appears to agree essentially with that present in *Nothrotherium* as shown on plate 12 of Stock's Gravigrade Cenozoic Edentates of Western North America.

Remarks.—The genus *Parocnus* is readily distinguishable from *Acratocnus* by the structure of the femur alone. If I have correctly assembled the other parts which I believe to be associated with it there are many important differential characters. These parts are as follows: (a) a right humerus (pl. 9), 200 mm. in greatest length, resembling that of *Nothrotherium shastense* as figured by Stock (Cenozoic Gravigrade Edentates of Western North America, pl. 8, fig. 1, 1925) in general form but less heavily built, with relatively broader proximal extremity and without the entepicondylar foramen present in this sloth and in *Acratocnus;* (b) the proximal third of a left tibia (pl. 8, fig. 2) and an entire left fibula probably of the same individual; (c) a right astragalus (pl. 9, fig. 3) very different from that of *Hapalops* as figured by Scott (Rep. Princeton Exped. Patagonia, Pal., Vol. 2, pl. 33, fig. 4) and *Acratocnus* as figured by Anthony (Mem. Amer. Mus. Nat. Hist., n. s., Vol. 2, pl. 73, fig. 7, 1918) but resembling in a general way, particularly in its calcaneal aspect, the very much larger calcaneum of *Megalonyx* figured by Stock (p. 87, fig. 31, *A, B, C, D*); (d) three calcanea (2 left, 1 right) of a form (pl. 9, fig. 2) conspicuously different from that seen in *Hapalops* and *Acratocnus* but essentially similar in plantar and astragalar views to the calcaneum of *Mylodon* as figured by Stock

(p. 175, fig. 96); (e) a fragment of an atlas much larger than the corresponding part in *Acratocnus odontrigonus* or *O.* (?) *comes*. The area of the superior articular process in this atlas is nearly four times as great as that of another specimen from the same cave (the large cave near St. Michel) which I refer without much hesitation to *O.* (?) *comes* (pl. 10, fig. 1); (f) several foot bones and ungual phalanges of more robust structure than any known in the Porto Rican Sloth.

PAROCNUS SERUS sp. nov.

Plate 7; plate 8, fig. 2; plate 9; plate 10, figs. 2, 3

Type.—Right femur (lacking epiphyses) of immature individual, No. 253228, U. S. Nat. Mus. Collected in large cave near St. Michel, Haiti, January, 1928, by Arthur J. Poole.

Characters.—An animal considerably larger and more heavily built than *Acratocnus odontrigonus* or *A.* (?) *comes*, its weight as roughly estimated by comparison of limb bones with those of pigs, probably 150 lbs. or more.

Femur.—As compared with that of *Acratocnus odontrigonus* the femur of *Parocnus serus* (pl. 7) is immediately distinguishable by the absence of the lesser trochanter, as well as by its greater size and the much more noticeable antero-posterior flattening of the upper portion of the shaft. In a large femur of *Acratocnus* (No. 17716, Amer. Mus. Nat. Hist.) the two diameters of the shaft at middle of its upper half, lateral and antero-posterior, are respectively, 26 mm. and 17 mm.; in the type of *Parocnus tardus* they are 38 mm. and 14.5 mm. The ratio of antero-posterior to lateral diameters is therefore about 65 in *Acratocnus* and only about 38 in *Parocnus*. At middle of shaft the discrepancy is slightly less: ratio of antero-posterior to lateral diameter about 61 in *Acratocnus*, about 45 in *Parocnus*. Below the middle of the shaft the diameters in the two femurs are essentially alike, with ratios of 58 and 59, a difference which is too slight to have any special significance.

In addition to this striking peculiarity of general form the femur of *Parocnus serus* is further distinguished from that of the known species of *Acratocnus* by the absence of a lesser trochanter and the presence of a low ridge about 35 mm. in length extending obliquely downward and backward from the middle of the neck across the narrow inner aspect of the bone to its posterior margin; by the more thickened gluteal ridge; and by the presence of a noticeable con-

cavity on the posterior face of the shaft at the base of the great trochanter.

Unfortunately no perfect skulls of ground sloths have yet been found in the Haitian caves. One specimen from the small cave near St. Michel includes the interorbital region and anterior part of the braincase. It is about the size of the corresponding part of the skull in a large *Acratocnus odontrigonus,* but is conspicuously different in form, owing to the absence of the deep postorbital constriction which is such a noticeable feature in the skull of *Acratocnus.* Whether this fragment pertains to a skull of *Parocnus* or of *Acratocnus* (?) *comes* is a question which cannot be answered. A fragment of a palate from the same cave appears to have come from a skull of much the same size. It indicates a palate twice as wide in proportion to the length of the toothrow as that of *Acratocnus odontrigonus,* and it further differs from the palate of the Porto Rican sloth in the presence of a median longitudinal ridge supplemented, on each side, by a shallow but well-defined longitudinal furrow. The toothrow in this individual was probably of almost exactly the same length as that of the Porto Rican specimen figured by Anthony on plate 69 (fig. 1*c*).